S
~~620.002~~ 354.367
Z1r
1920

STATE DOCUMENTS

NINTH BIENNIAL REPORT
OF THE
STATE ENGINEER

AND OF THE

CAREY LAND ACT BOARD

FOR THE YEARS
1919--1920

Montana State Library
3 0864 1006 6071 4

Digitized by the Internet Archive
in 2014

http://archive.org/details/biennialreporto1919mont_0

NINTH BIENNIAL REPORT

of the

STATE ENGINEER

and of the

CAREY LAND ACT BOARD

of the

STATE OF MONTANA

1918-1920

C.S.HEIDEL. STATE ENGINEER.

Helena, Montana,
November 30,1920

To His Excellency,
Honorable S. V. Stewart
Governor of Montana

Sir:

In accordance with the provisions of Section 2284, Revised Codes of 1907, I have the honor to submit herewith the Ninth Biennial Report of the State Engineer covering the work of this Department for the past two years.

Respectfully,

C. S. Heidel.

State Engineer.

REPORT OF THE STATE ENGINEER.

INTRODUCTION.

The office of State Engineer was created in 1903 and was first filled by Mr. John Wade who served for eight years until 1911 when Mr. A. W. Mahon was appointed. Mr. Mahon conducted the affairs of the office in a most able manner, and was [illegible] reappointed for four terms. After serving one year of his third term he resigned, and the present state engineer was appointed to succeed him, taking charge of the office April 1, [illegible]

CAREY LAND ACT BOARD.

The chief reason for the creation of the office of State Engineer was to provide an officer to supervise the work of the Carey Land Act Board. Since April 1 the State Engineer has spent about one-fourth of his time on Carey Act project matters. The report of the Carey Land Act Board, of which the state engineer is secretary, accompanies this report.

STREAM MEASUREMENTS.

Paragraph [illegible] Section [illegible] of the Revised Codes of [illegible] reads in part as follows:

"The State Engineer shall become conversant with the waterways of the state and the needs of the state as to irrigation matters. Shall make or cause to be made, measurements and calculations of the ordinary and flood discharge of streams, co-operating in this work as much as possible with the U. S. Geological Survey and the Montana Experiment Station; . . . .".

In accordance with the above law this office has co-operated since 1908 with the Water Resources Branch of the U. S. Geological Survey. This work has been under the general direction of Engineer William A. Lamb, District Engineer since [illegible], and since [illegible] the state engineer's office has employed a hydrographer who has devoted a large share of his time to co-operative stream measurement work. This position was filled by Mr. [illegible] from July 1, [illegible] until April 1, [illegible], and the vacancy has been filled since [illegible] by Mr. George Henry Ellis. Mr. Ellis is an experienced irrigation and hydrometric engineer, having been previously employed by the U. S. Reclamation Service since 1907; and his work for this department has been very satisfactory.

Tables have been prepared showing the stream flow data at over 100 stations for 1916-1919 similar to those we have published in our fifth, sixth, and seventh biennial reports. We received frequent requests for these data, and we have them in suitable form to send to the printer whenever funds are available for their publication.

Because of the importance of stream measurement work and the limited amount of stream-flow data available, I have personally given all my attention to this subject when not employed on other work required by the office.

The extremely dry weather of the past few years as well as the natural agricultural development of the state has strongly impressed on our people the advantages of irrigation. In considering any proposed irrigation project, most people realize that one of the essential requirements is an ample water supply. But frequently it is not realized until a competent irrigation engineer is employed to make an investigation, that often the most difficult part of the problem is to estimate the amount of water available. In our reports on proposed irrigation districts we have usually been handicapped by the lack of stream-flow data, and in some cases it is impossible to determine whether or not a project is feasible simply because we do not have sufficient water supply records. In order to be of value a stream flow record must extend over a period of years, and we should begin to collect such data in advance of the time when it is required. If we are to intelligently plan additional irrigation development, and forestall "wild cat" irrigation schemes, we must provide ample funds for a thorough study of our water supply.

IRRIGATION DISTRICT LAW

By the provisions of Chapter 14, Session Laws 16th Legislative Assembly, Extraordinary Session 1919, the State Engineer is required to make preliminary investigations of, and render engineering advice relative to, proposed irrigation districts. For the information of the Montana Irrigation Commission, a portion of this law reads as follows:-

SECTION 1. . . . . The Attorney General shall act as legal adviser of the Montana Irrigation Commission, and the State Engineer shall make such preliminary investigations and render such engineering advice, as may be required of him by the terms of this Act. No extra compensation shall be paid to any member or employee of the State Board of Railroad Commissioners or the State Engineer or the Attorney General, by virtue of any duties imposed by this Act.

. . . .

. . . .

SECTION 4. RECOMMENDATION OF COMMISSION. . . . . A petition for the organization of an irrigation district shall be accompanied by a copy thereof, and it shall be the duty of the Clerk of the District Court, in which such petition is filed, to forward such copy to the Secretary of the Montana Irrigation Commission, who shall refer the same to the State Engineer, who shall advise the Commission of the estimated amount of his expenses in making a preliminary examination of the lands to be included in the proposed district and the source from which the lands are to be irrigated. The Secretary of the Montana Irrigation Commission shall thereupon advise the party or parties filing the petition for the proposed irrigation district, of the amount of the preliminary expenses of the State Engineer, which amount shall be forthwith paid to the Secretary of the Montana Irrigation Commission and by him turned over to the State Treasurer, to be credited to the Montana Irrigation Fund hereinafter created. Upon the payment of such amount to the Secretary of the Montana Irrigation Commission, the State Engineer shall make preliminary examination of the lands to be included in the proposed irrigation district and the source from which the lands are to be irrigated, and shall make a report to the Commission as to the feasibility and advisability of the creation of such proposed district. The expenses of the State Engineer (not including his salary) shall be paid out of the funds so deposited with the Secretary of the Montana Irrigation Commission, and any surplus, over and above said expenses of the State Engineer, shall be returned to the petitioners by a warrant drawn upon the Montana Irrigation Fund. . . . . ".

The engineering work required by the examinations of the fifteen districts which have already petitioned the Irrigation Commission has been of such volume that it was physically impossible for any one engineer to handle it. In fact, it has demanded almost the entire attention of three engineers in addition to the time Mr. Lange and I have spent on it. I have given about one-sixth of my time since April 1 to work in connection with irrigation district reports, and Mr. Lange has spent a number of weeks and put in a good deal of overtime preparing reports for submission to the Commission.

The State Engineer is not provided with deputies or funds with to employ them, so Mr. F. E. Buck, Engineer for the Irrigation Commission, and Mr. J. Winter Smith, Assistant Engineer for the Irrigation Commission were appointed Deputy State Engineers in order to handle this work. With the assistance of Mr. Edward Hopkins, Assistant Engineer for the Irrigation Commission, these men did practically all the engineering field work, consulting with me on the more important features and in preparing the reports. Since the appropriation for the work of the Irrigation Commission was entirely inadequate, these men have been working without salary since June 1 and are entitled to a deficiency claim for their services. Provision should be made for salaries of deputies to handle this work.

RECOMMENDATIONS

The status of water rights in this state is so unsatisfactory that it was recognized by the Senate at the last legislative session to the extent that a Senate Committee was appointed to consider remedial legislation and report at the coming session. The Montana Irrigation and Drainage Institute has devoted considerable time to the compilation of a modern water right code. The question of water rights has been discussed in many previous reports of this office, so I will not repeat details at this time. I heartily endorse the sentiment in favor of a more satisfactory water right code, and recommend that the coming legislature pass such a code providing for the appropriation, recording, adjudication, and administration of water rights.

In order to make investigations and prepare reports on proposed irrigation districts for the Montana Irrigation Commission as explained in previous paragraphs it is essential that money be provided to pay the salaries of men to do the work. I therefore recommend that $7,500 be appropriated for the year 1921 and $7,500 for the year 1922 to pay salaries of deputies on irrigation district work.

In order to secure the stream flow data necessary for sane and conservative irrigation developments as previously explained, as well as to obtain more stream measurements to aid in the study of power possibilities I recommend the appropriation of $15,000 for the year of 1921 and $15,000 for the year 1922 to be expended in cooperation with the U. S. Geological Survey in making stream measurements.

REPORT OF THE

CAREY LAND ACT BOARD

of the

STATE OF MONTANA

for the

YEARS 1919-1920

The Carey Land Act Board, during the past two years has been composed of Governor S. V. Stewart, Chairman; Attorney General S. C. Ford, and Secretary of State C. T. Stewart. [illegible], State Engineer, is the ex-officio Secretary and Supervising engineer of the Board, succeeding Mr. [illegible] who resigned in April 1920 and F. A. Lange is Assistant Secretary, filling the place of Mrs. C. B. [illegible], resigned.

The Carey Land Act Board continues to be self supporting and the past two years have been very gratifying, both from a financial standpoint and the successful operation of the projects.

The year of 1919 proved to be one of the most disastrous to the dry land farmer in the history of the state, which had the tendency to make irrigated lands very popular and stimulated the demand for new projects.

The total area of lands segregated to the state under the Carey Act amounts to 175,460.22 acres of which a total of 51,[illegible] acres have been sold to settlers.

The indebtedness incurred by the old Arid Land Grant Commission has practically been liquidated, a total of $17,[illegible] having been paid on this liability with a substantial balance on hand with which to carry out the further provisions of the Carey Act which states: "- - - and any surplus of money derived by the State from the sale of said lands in excess of the cost of their reclamation, shall be held as a trust fund for and be applied to the reclamation of other lands in such State."

The closing of the biennial period of 1919 and 1920 marks the successful completion of the Billings Bench Project, with the reclamation and settlement of the lands segregated to the State

in [illegible] and 7 having been practically completed. The operation and maintenance of the project has been under the direction and management of the Water Users' Association for the past two years, and a movement is now under way to make a sufficient showing and petition the Carey Land Act Board to relinquish control to the Water Users' Association.

We herewith give a detailed statement of the several projects as of date November 30, 1920:

BILLINGS PROJECT.

This project, commonly known as the "Billings Bench" lying northeast of the City of Billings, includes 13,223.54 acres of Carey Act lands of which a total of 12,264.62 have been sold.

The total acreage patented to the State by the Department of the Interior under this project is 13,223.54 acres of which the State has patented to the settlers the amount of 9,876.39 acres.

The affairs of the Billings Land & Irrigation Company, which is the company contracting with the State for the reclamation of the lands under the project, are still in the hands of the Merchants Loan Company as Trustee. The Trustee has an arrangement with the settlers, under the name of the "Billings Bench Water Association", for the operation and maintenance of the system as required by the State.

As a matter of fact, the Billings Bench Water Association has practically had control of the system for the past two years. They have employed their own manager who is also their engineer, and have levied and collected maintenance fees. Old structures have been replaced by works of more permanent nature, and all new structures are of a capacity ample for maximum ultimate requirements.

In the near future, the settlers thru their organization, Billings Bench Water Association, expect to make a sufficient showing to the Carey Land Act Board in order that the control of this project may be released from the State to the settlers.

During the dry year of 1919, the Yellowstone River was at its lowest stage of record and thruout its reach in Montana there were only four projects that had a good water supply, among which was included the Billings Project. Therefore the State may well point with pride to the successful completion of this project, lands of which are bringing as high as $300 per acre.

The statement of the Company up to November 30, 1920, is as follows:

ITEMIZED DESCRIPTIVE STATEMENT BY THE COMPANY.

Name of Project: Billings.

Name of Company: Billings Land & Irrigation Company, Merchants Loan Company, Trustee.

Post Office Address: Billings, Montana.

LOCATION.

County: Yellowstone County.

Townships: 1 to 3 N., Rgs. 26 to 28 E. Montana Meridian.

Railroads: Northern Pacific; Chicago, Burlington & Quincy; Great Northern; Billings & Central Montana.

Railroad Stations: Billings and Shepherd.

Population of Towns: Billings 16,000; Shepherd 100.

AGRICULTURAL AND CLIMATIC CONDITIONS.

Average elevation of irrigable area 3,200 feet above sea level.

Topography: Bench land, crossed by five creeks, generally level, sloping north and east.

Rainfall on irrigable area for 10 years, average [illegible] inches; for 1919, 10.93 inches; for 1920, 9.50 inches up to October 1, 1920.

Range of Temperature on irrigable area, -30° to 100° F.

Length of irrigating season April 15 to Oct 15; 183 days.

Character of soil of irrigable area: Sandy loam to clay loam.

Principal markets: Billings, Butte, Minneapolis, St. Paul.

Principal products of project: Wheat, alfalfa, oats, sugar beets.

DESCRIPTION OF WATER SUPPLY.

Stream from which water supply is obtained: Yellowstone River.

Whether natural flow, stored water or both: Natural flow.

Water otherwise appropriated in stream: No data.

NUMBER OF RESERVOIRS WITH AREA AND CAPACITY OF EACH.

1. [illegible] Lake Reservoir, area [illegible] acres, capacity [illegible] acre feet.

2. [illegible] Reservoir, area [illegible] acres, capacity [illegible] acre feet.

CANALS LEADING FROM STREAMS TO LAND OR RESERVOIRS

Main Canal, 61 miles long, capacity of head 500 second feet.

Length of main canals completed. 61 miles.

Length of main canals to be built. None.

Length of main laterals completed. 100 miles

Length of main laterals to be built. None.

Length of distributing laterals completed. Included in main laterals.

Length of distributing laterals to be built. None.

Total length of main canals and laterals completed. 161 miles.

Character of construction. Fair to excellent.

GENERAL DESCRIPTION AND NUMBER OF STRUCTURES.

The project has a gravity water supply. The main canal follows a uniform grade contour down the Yellowstone valley on the north side of the river. There are nine major structures on the main canal and several hundred minor structures on the canal and lateral system.

ENGINEERING DIFFICULTIES.

The principal features are: a concrete headworks with protection from flood water in the river; a tunnel 1,347 lineal feet long driven thru rock, a 7.5 foot diameter wood stave banded pipe inverted siphon 1,650 lineal feet long; about 4,000 lineal feet of rock cut.

Total acreage within the boundaries of the project 40,992 acres.

Carey:	15,229.58 acres.
Company Deeded:	18,975.00 acres.
Private:	5,667.10 acres.
State:	1,120.00 acres.
Railroad:	none.

Total acreage to be actually irrigated by the project: 19,691 acres.

Sales:

Total Carey acreage filed on: 12,360 acres

Carey acreage filed on susceptible of irrigation: 9,558 acres

Company Deeded acreage sold: 17,947 acres

Company Deeded acreage sold susceptible of irrigation: 9,971 acres

Total water stock sold: 20,943 shares.

Total acreage sold to date: 29,307 acres

Total irrigable acreage sold to date: 18,529 acres

Total Carey lands open for entry: 957 acres

Carey acreage irrigable open for entry: 41 acres

Total Deeded acreage unsold. 1,958 acres

Deeded acreage irrigable unsold: 937 acres

Total estimated cost of the project. $500,000.00

Total expenditures to October 31, 1920: $508,000.00

Price of water rights per acre for Carey Act lands: $35-$55

Price of water rights per acre for Deeded lands: $35

Price of water rights per acre other than above. $35

Water rental per acre per season on lands other than company: none.

Terms of payments on water contracts: An initial payment from 10 to 25 per cent cash at time of purchase, the remainder payable in ten equal installments and all deferred payments bearing interest at 6 per cent.

What necessities for a drainage system have arisen? There are several water-logged areas for which drainage is needed.

What character of drainage has been adopted and to what extent actually constructed? Several miles of open drains have been built which are very effective.

Amount of water per acre required to be furnished by the Carey Land Act Board: One cubic foot per 100 acres per second.

Amount of water actually required by the land: No data

Method of measuring water to the farm units: There are a few measuring devices installed but in most instances quantities are estimated.

Method of recording water deliveries: No record kept during 1920.

Amount charged per irrigable acre for maintenance as per contract with the Carey Land Act Board: $1.00

Actual cost of maintenance per acre for the year 1920: $2.75 per acre of which about $1.25 per acre was expended on replacements and improvements.

SETTLEMENT DATA BILLINGS PROJECT.

Item	1913	1914	1915	1916	1917	1918	1919	1920
Number Farms on Project								300
Population								1200
Number irrigated Farms								300
Operated by owners								
Operated by tenants								
Number of Towns								1
Population								100
Number of Public Schools								6
Number of Churches								2
Number of Banks								1
Total capital stock							$20,000	
Amount of deposits							$150,000	
Number of depositors								

BIG TIMBER PROJECT.

The lands embraced in this project lie near Big Timber and the contracting company is the Glass-Lindsay Land Company.

The total area of Carey Act lands within the project is 11,299.16 of which the total sales comprise 6,174.94 acres. Total area patented to the State by the Department of the Interior is 8,229.84 acres and the total area patented to the settlers is 3,619.32 acres.

The statement of the Company up to November 30, 1920, is as follows:

ITEMIZED DESCRIPTIVE STATEMENT OF THE COMPANY.

Name of Project: Big Timber.

Name of Company: Glass-Lindsay Land Company.

Post Office Address: Big Timber, Montana.

LOCATION:

County: Sweetgrass County

Townships: 2 to 3 N., Ranges 14 to 15 E., Montana Meridian.

Railroads: Northern Pacific Railroad.

Railroad Stations: Big Timber.

Population of Towns: Big Timber, 1,300; Melville, Glasston,

AGRICULTURAL AND CLIMATIC CONDITIONS:

Average elevation of irrigable area 4200 feet above sea level.

Topography: Rolling with very considerable areas of level plain including some [illegible] range lands.

Rainfall on irrigable area for 11 years, average 16.12 inches; for 1919, 11.85 inches; for 1920, [illegible] inches up to October 1, 1920.

Range of Temperature on irrigable area [illegible] below to [illegible] F.

Length of irrigating season June 1 to Sept. 15; 100 days.

Character of soil of irrigable area: Clay loam.

Principal products of project: Grain, potatoes, hay, stock.

Principal markets: Big Timber, St. Paul, Spokane.

DESCRIPTION OF WATER SUPPLY.

Stream or streams from which water supply is obtained:

Sweetgrass Creek, Big Timber Creek, Otter Creek.

Whether natural flow, stored water, or both: Both.

NUMBER OF RESERVOIRS WITH AREA AND CAPACITY OF EACH.

1. Upper Reservoir, area 585 acres, capacity 9,000 acre feet.
2. Lower Reservoir, area 768 acres, capacity 22,900 acre feet.

CANALS LEADING FROM STREAMS TO LAND OR RESERVOIRS.

Intake Canal,	1.57	miles long,	capacity 600	second feet.
Big Timber Canal,	13.0	miles long,	capacity 125	second feet.
High Line Canal,	16.5	miles long,	capacity 150	second feet.
Low Line Canal,	17.5	miles long,	capacity 175	second feet.
Adam Canal,	4.6	miles long,	capacity 13	second feet.

Length of main canals from reservoir completed:	53.17 miles.
Length of main laterals completed:	52 miles.
Length of main laterals to be built:	24.0 miles.
Length of distributing laterals completed:	14.0 miles.

Length of distributing laterals to be built: not known.

Total length of canals and laterals completed: 119.1 miles.

Character of Construction:

In the design of all the canals, Kutter's formula for the value of co-efficient "c" was used and a value of "n" taken as 0.25
The side slopes for the canals built in earth are 1 to 1 in the cuts and 1½ to 1 in fill. The width of the banks on top range from 3 to 5 feet.
The streams, gulches and coulees are crossed by means of flumes.

GENERAL DESCRIPTION AND NUMBER OF STRUCTURES.

Diversion Works in Sweetgrass Creek:

Built of re-inforced concrete with [illegible] openings each [illegible] feet wide, with wooden gates.

Headgate in Big Timber Creek: Built of wood.

Lower Reservoir:

The Lower Reservoir is a storage reservoir having a capacity of 22,390 acre feet. Its construction required an earthern dam 1275 feet long and [illegible] feet high, with an inside puddle core wall. Outside slope is 1½ to 1, inside slope is 3 to 1 and is riprapped. 12 foot roadway on top. The outlet consists of three 18 inch steel pipes laid in concrete, with brass valve gates for controlling the flow.

Upper Reservoir:

The Upper Reservoir is a storage reservoir with a capacity of 9,000 acre feet. Its construction required four earthern dams outside slope 1½ to 1 and the inside slope 3 to 1, riprapped on the water side. The dams being built with puddled core walls. There are two outlets, one to the High Line Canal has 6 16 inch steel pipes laid in concrete with brass valves controlling the flow. Outlet to the connecting canal between the reservoirs has [illegible] inch and one 16 inch steel pipes laid in concrete each with a brass control gate.

Total Acreage Within the Boundaries of the Project.

Carey,	11,299.16 acres.
Company Deeded,	19,300.00 acres.
Private,	none
State,	none
Total,	30,599.16 acres.

Total acreage to be actually irrigated by project:

17,000 acres.

Sales:

Total Carey acreage filed on: 6,174.94 acres

Carey acreage filed on susceptible of irrigation: 4,768 acres.

Total Carey Act lands open for entry: 5,114.22 acres

Total Expenditures up to November 30, 1920: $1,000,000.00

Price of Water Rights per acre for Carey Lands: $50 to $60

Price of Water Rights per acre for Company Lands: $50 to $60

Terms of Payments on Water Contracts: From 2 to 10 per cent in cash on first payment and deferred payments run from 1 to 10 years and bear 6 per cent interest.

What necessities for a Drainage System have Arisen?

At present there are three small spots that require this attention.

What Character of Drainage has been Adopted and to What Extent Actually Constructed?

Nothing has been done.

Amount of Water per Acre Required to be Furnished by the Carey Board:

1½ acre feet.

Amount of Water per Acre Actually Required by the Land:

Not determined.

Method of Measuring Water to the Farm Units: None.

Method of Recording Water Deliveries: None.

Amount Charged per Irrigable Acre for Maintenance as per Contract with Carey Land Act Board:

$0.50

VALIER PROJECT.

This project embodies a total segregation of 85,380.14 acres of Carey Act land, 56,782 acres of which are irrigable. Total amount sold is 62,609.20 acres of which 43,443.21 acres are irrigable. Total amount sold during the past two years is 6,383.73 acres for which the State received $9,576.46.

The General Land Office has issued patent to the State for 34,708.92 acres of which 31,781.07 acres have been in turn patented to entrymen.

During the past two years much work has been done toward the ultimate completion of the project. Many temporary structures have been replaced by more permanent ones of concrete. In 1919 the old outlet from Lake Francis into Canal "C", which had been constructed sometime in 1910, was partially torn out and a new outlet installed which has an increased capacity. During the past biennial period a total of 25,000 cubic yards of material were put into place in Dyke No. 1. An exhaustive study of the drainage and seepage problems has been maintained with a view of remedying all such cases.

The statement of the Company up to October 31, 1920, follows:-

ITEMIZED DESCRIPTIVE STATEMENT BY THE COMPANY.
October 31, 1920.

Name of Project: The Valier Project.

Name of Company. The Valier-Montana Land & Water Company.

Post Office Address: Valier, Montana.

LOCATION.

County: Pondera.

Townships 28 to 31 N., Rs. 2 to 10 W. Montana Meridian.

Railroads: The Montana Western Ry & Great Northern Ry.

Railroad Stations: Conrad, Manson, Williams, Valier.

Population of Towns: Conrad 980, Manson 5, Williams 50, Valier 410.

AGRICULTURAL AND CLIMATIC CONDITIONS.

Average elevation of irrigable area [illegible] feet above sea level.

Topography: The tract lies in a gently rolling prairie-like country, clear of brush and trees, and covered with a heavy sod of blue joint and buffalo grass. The land drains in a Northeasterly direction on a gradient of fifty feet to the mile to the Marias River.

Rainfall on irrigable area for 8 years, average 11.[illegible] inches; for 1919 5.47 inches; for 1920 9.26 inches [illegible]

Range of temperature on irrigable area: -35° to 95° F.

Length of irrigating season, May 1st to Sept 15; 138 days

Character of soil of irrigable area: The soil throughout the project is fertile and deep beyond all practical purposes. Canal excavations and wells dug show that in places it attains a depth of nearly 80 feet. It consists of heavy loam in which the proper proportion of lime is large and of clay small. It is easily worked after first breaking and holds water well. The surface soil retains 60 percent of water when saturated and the subsoil 40 percent. Owing to the arid climate, the soil is unbleached and unwashed, and has retained an abundance of soluble salts thereby accounting for its high yields under cultivation.

Principal products of project: wheat, oats, barley, alfalfa.

Principal markets: Valier, Williams, Conrad, Great Falls.

DESCRIPTION OF WATER SUPPLY.

Streams from which water supply is obtained: The water supply for this project is derived mainly from Birch Creek, a mountain stream flowing the year round from the east slope of the Rocky Mountains. This creek drains an area of 150 square miles above the intake works of the Birch Creek Canal. A short distance upstream from this intake, the Government has maintained a gaging station for a period of thirteen years. The records show that the flow of this stream for the season is not sufficient to take care of the project by direct flow. The Birch Creek Reservoir was consequently adopted as being necessary. The dam impounding this water, called the Swift Dam is now completed. The flow from Birch Creek is supplemented by Dupuyer Creek which has a drainage area of 111 square miles. It is intended to use both normal flow and flood water.

NUMBER OF RESERVOIRS WITH AREA AND CAPACITY:

1. Birch Creek Reservoir, 506 acres, capacity [illegible] acre ft.

2. Lake Francis Reservoir, 5,536 acres, capacity 112,000 acre feet.

CANALS LEADING FROM STREAMS TO LAND OR RESERVOIRS.

Birch Creek Canal, 14.2 miles long, capacity 700 second feet.

Dupuyer Creek Canal, 3.3 miles long, capacity 900 second feet.

C-3 Canal, 2.2 miles long, capacity 900 second feet.

Length of main canals from reservoir completed 29.[illegible] miles, remaining to be built, none.

Length of main laterals completed, 133.7 miles, remaining to be built, 7.8 miles.

Length of distributing laterals completed, 292.0 miles, remaining to be built, 6.3 miles.

Total length of canals and laterals completed 474.6 miles, remaining to be built, 14.1 miles.

Character of construction: The canals almost entirely of earth section, structures are built according to the most up-to-date engineering practices. Most of the canals and structures are built for possible larger capacities in the future, and are of more than ample size to take care of all present and future needs.

GENERAL DESCRIPTION OF STRUCTURES.

The Swift Dam and affiliated structures.

Main Dam:

Character: Arched rock-filled with concrete facing, placed between solid rock walls of Birch Creek Canyon.
Height: 157 feet.
Length of top: 470 feet.
Rise of arch at center: 20 feet.
Width of base: 391.55 feet.
Width of crown: 15 feet.
Upstream slope: 1:1 to 100 foot level; 1.2:1 to 154 foot level; vertical to 157 foot level.
Downstream slope: 1.33:1.
Foundation: Natural creek bed, sand, gravel, boulders.

Facing:

Area covered: Total width from creek bed to 154 foot level.
Thickness: 18 inches thick at creek bed to 8 inches at 154 foot level.
Reinforcement: One-half inch square twisted steel bars, 4 inches from center to center along the slope and 5 inches from center to center horizontal.
Expansion joints: 50 feet center to center and extends from the 50 foot level to top of coping. (el 159).
Cut-off sides of canyon: Facing extends 8 feet into solid rock on sides of canyon.

Coping:

Height: 5 feet, extends vertically from 154 foot level to 159 foot level.
Relation to facing: Connected at top with facing at 154 foot level.
Thickness: 12 to 24 inches.
Form: Back vertical, face curved
Purpose: To deflect waves away from fill

Cut-off wall:

Relation to facing: Connects with facing at creek bed.
Depth, maximum: From creek bed to 2 feet into solid rock, 33 feet.
Width: 9 feet.
Sides: Entered into solid rock on sides of canyon 2 feet.

Rock blanket on upstream face:

Relation to facing: Placed over facing from creek bed to 106 foot level.
Height: 106 feet.
Crown width: 17.5 inches.
Slope on upstream side: 1.5:1

Berm at downstream toe:

Purpose: To protect downstream toe from erosion by discharge of valves.
Height: 12 feet
Crown width: 20 feet.
Slope face: 1.1:1.
Maximum base width of dam and berm over all: 677.75 ft.
Maximum height of dam from creek bottom to top of coping: 159 feet.
Maximum height of dam from bottom of cut-off wall to top of coping: 192 feet.

Quantities:

Total number of cubic yards in fill, measured by excavation: [illegible] yards
Percentage swell of rock measured in fill, over that measured in quarries: 30 per cent.
Total cubic yards of concrete placed: [illegible] yards.
Total lineal feet of steel used: 410,[illegible] feet.

Outlet tunnel:

Character: Driven thru solid lime stone rock.
Length: 568 feet.
Width: 7 feet.
Height maximum: [illegible] feet, 5 3/4 inches.
Form of bottom: Level.
Form of sides: Vertical for 4 feet, [illegible] inches, to spring line of arched top
Form of top: Arched on radius of [illegible] feet, [illegible] inches.
Concrete lining: Maximum thickness 9 inches, minimum thickness 4 inches.
Seal between lining and rock: Grout pumped in under a pressure of 125 pounds per square inch.

Regulating works outlet portal:

Four 36-inch Crane valves, tested to 120 pounds pressure per square inch, connected with steel pipe 7 feet in diameter and ½ inch thick, which extends into the tunnel and inside of the tunnel lining 100 feet.

Double trash rack upper portal:

Front rack: Consisting of 20 pound railroad rails placed on a steep slope around the tunnel inlet and held in place by 60 pound railroad rails placed horizontally and connected with the 20 pound rails by yokes and plates manufactured from 3/4 inch material
Rear rack: Placed adjacent to tunnel portal and inside of front rack, consisting of steel bars ½ inch thick by 3 inches wide, set on edge [illegible] inches from center to center and supported by heavy concrete foundations and steel eye beams.

Valve house and outlet culverts

The valve house is a re-inforced concrete structure, built into the outlet portal of the tunnel, enclosing the valves and the operating mechanism.

Outlet culvert is double barrel and leads from the valves to the creek bed below the dam, one barrel accommodating the discharge from two valves. Each barrel of the culvert is 6 feet, 6 inches wide and 7 feet high. The walls of the structure are curved downstream so the discharge from the valves may be deflected away from the toe of the dam.

Maximum estimated discharge of outlet works under full head is 2,500 cubic feet per second.

Quantities in tunnel and regulating works.

Cubic yards of solid rock excavation: 2,002 yards.
Cubic yards of concrete: 560.5 yards.
Pounds of metal set: 91,765 pounds.
Sacks of cement used: 4,392 sacks.
Lineal feet of re-inforcing steel used: 7,200 feet.

Earth and Rock Fill Dyke:

Location: 700 feet northwest of main Swift dam.
Character: Earth and rock fill, resting on solid rock from center to south end and on earth from center to north end.
Maximum height: 40 feet.
Length of crest: 400 feet.

Rock section:

Upper slope: 1-3/4 to 1.
Lower slope. 1-1/3 to 1.
Crown width: 5 feet.

Earth section (on upstream side of rock section)

Upper slope: 3 to 1.
Riprap. Upper slope of the earth section is covered with a layer of rock, 2 feet thick, dumped in place. This material was taken from the spillway excavation.

Cut-off wall:

Concrete cutoff wall is 6 feet high, being 12 inches wide at the top and 24 inches wide at the base. This wall extends two feet into solid rock or 5 feet into the earth, depending upon the character of the foundation encountered. It is located well within the earth portion of the structure.

Quantities placed in dyke:

Cubic yards of solid rock excavation: [illegible] yards,
Cubic yards of earth excavation: [illegible] yards
Cubic yards of concrete: 168 yards
Square yards of rip-rap: 4,351 yards,
Sacks of cement used: 917 sacks

Spillway

A concrete lined spillway having a total length from the upstream end of the spillway lip to the outlet end of the channel of [illegible] feet and a bottom width of [illegible] feet with slopes of [illegible] to 1 at a vertical height of from 12 feet 2½ inches at the downstream end of the spillway lip, to 10 feet, 4½ inches at the outlet end, was originally constructed to pass the excess water over and above the reservoir capacity of 30,000 acre feet.

Quantities moved and in original Spillway:

Cubic yards of solid rock excavation: 1[illegible],150 yards.
Cubic yards of concrete, 969.9 yards.
Sacks of cement 4,469 sacks
Square feet of wire mesh used: 7,516 feet
In 1917 an enlargement of this spillway was planned and construction activities started immediately. This enlargement necessitated the excavation of 25,396 cubic yards of rock. This waterway has an average bottom width of 60 feet, the enlarged portion being unlined. The length of the actual spillway lip is 395 feet and is at an elevation of 147 feet above the creek bed, or at an elevation representing the maximum storage capacity of the reservoir, or 30,000 acre feet. The computed discharge of the spillway is [illegible] cubic feet per second with a depth of water over the lip of 4 feet, or an elevation of water surface of 151 feet above the creek bottom. The cost of this enlargement was $26,360.

Summary of Quantities of Rock, Earth and Material Moved and Placed in the Swift Dam and Affiliated Structures, the Spillway and Rock Fill Dyke:

Solid rock excavation: 243,451 yards.
Loose rock excavation: 802 yards
Earth excavation: 23,851 yards
Square yards of riprap placed: 4,360.6 yards.
Cubic yards of concrete placed: 5,873.9 yards
Sacks of cement used: 36,688 sacks

Total number lineal feet of ½ inch square twisted re-inforcing steel used: 417,311.1 feet.
Square feet of triangular wire mesh used: 7,515 feet.
Pounds of metal set: 91,768 pounds.
Total tonnage hauled from Valier to Swift Dam site, distance of 34 miles: 2,026.36 tons.
Total cost of Swift Dam and affiliated structures: $522,291.09.
Total amount of water impounded: 30,000 acre feet.
Cost of storage per acre foot: $17.41.
Maximum recorded height of water in reservoir above creek bottom: 153.5 feet.
Maximum depth of water recorded passing over spillway lip: 6.5 feet.
Maximum discharge thru spillway, feet per second on June 22, 1916: 4,713 second feet.
Maximum seepage measured from under main dam with 134 feet of water in reservoir on January 11, 1916: 4.88 second feet.
Maximum settlement to date, measured on top of coping: 2.50 feet.
Spillway as enlarged has a carrying capacity of 8,000 cubic feet per second.

Lake Frances Dam and Affiliated Structures:

Main Dam;

An earth dam, 40 feet high and 600 feet long on top, with re-inforced concrete core wall and double 53 inch barrel tunnel outlet, with concrete gate tower.

Lake Frances Dyke No. 1;

An earth dyke, partially completed, being 6,230 feet long on top with a maximum height of 20 feet, a crown width of 12 feet, an outside slope of 1 1/3 to 1, and an inside or water slope of 3 to 1. 25,000 cubic yards of material were placed during the past two years. Cut-off trench 3 feet wide and 8 to 20 feet deep excavated and back-filled with damp clay and tamped into place. Completed face of the dyke riprapped with gravel to elevation 3809 feet.
Old outlet partially torn out and a new outlet installed with increased capacity. Total capacity 431 second feet.

Lake Frances Dyke No. 2:

A small earth dyke on the north shore of Lake Frances at the eastern boundary of the townsite of Valier. This dyke is 725 feet long, with a maximum height of 4 feet, having a volume of 1,725 cubic yards of earth. When dykes nos. 1 & 2 are completed, Lake Francis Reservoir will hold its computed capacity of 112,000 acre feet of storage.

Big Flat Coulee Siphon:

This siphon consists of 929 feet of concrete pressure pipe, 7 feet in diameter and 2,918 feet of wood stave pipe, 78 inches in diameter with concrete intake and outlet structures. The wood stave pipe is under a 150.3 foot head at the lowest point of the coulee and has a capacity of 360 second feet.

Birch Creek Diversion Dam:

This diversion dam is located on Birch Creek about 12 miles below the Swift Dam and is used for diverting water into the Birch Creek canal. This consists of a re-inforced concrete gate structure, 50.5 feet wide, containing 6 steel gates at the gate openings, each 4 x 6 feet. The elevation of the bottom openings is 4,170.7 feet. In addition to this, the structure has a section 18 feet long, containing what is known as the prior right gate, which has been constructed to allow the required amount of prior right water appropriations to pass along the creek. This gate opening is 4 x 6 feet, the 18 foot section containing also a sluice gate 4 x 6 feet, the bottom of which is on the level with the floor of the structure and constructed in this manner so that all sediment lodging in the structure may be sluiced out.

There is also an earth dyke at this location, 1,800 feet long, having a crown width of 6 feet. This dyke has a top elevation of 4,180 feet, which is the elevation of the top of the headgate structure. This dyke was constructed so that in time of maximum flood in Birch Creek when the water is estimated to go over the diversion weir at a depth of 4 feet, the valley on the south side of the "B" canal will not be flooded.

The diversion weir itself is a cyclopian concrete gravity section, being 384 feet long and 2½ feet wide on top. The water side is vertical and the downstream side is on a slope of 2/3 to 1. The

elevation of the top of this diversion weir is 4,175 feet and is 8 feet above the creek bed. The base of the weir section is 8 feet and a cut-off is constructed at the upstream and downstream edges of the base. These cut-offs are carried down into impervious material.

The downstream floor or apron upon which the water falls, is 19.5 feet long and is 1 foot thick. Another cut-off wall is constructed at the end of this apron to prevent back-scour under the floor.

The total cost of the diversion weir is $53,000.00

Concrete and Timber Drops on the Birch Creek and Dupuyer Creek Canals.

On the Birch Creek canal there are two re-inforced concrete drops, one a 5 foot drop and the other a 11 foot drop, both of a capacity of 700 second feet. About 80 feet of excess grade in the Birch Creek canal is taken up by 35 2½ foot combination concrete and timber drops, and in the Dupuyer Creek canal there are 5 of these drops. These drops are constructed of heavy timber aprons and floors with concrete wing walls.

Dupuyer Creek Diversion Weir and Headgates:

A concrete diversion weir of the ogee type on a gravity section is constructed across Dupuyer Creek. This weir is 196 feet long and 7.8 feet high. The gate structure is of re-inforced concrete and contains 6 gate openings, each 7.75 x 5 feet. Five of these discharge into the canal and one is used as a wasteway to discharge back into the creek. The capacity of the Dupuyer Creek canal is 900 second feet, 700 of which is supplied by the Birch Creek canal and 200 by the waters of Dupuyer Creek.

Drops:

In constructing drops on the project, a system has been followed of using re-inforced concrete in all canals of a capacity of 20 second feet or over and timber is used in all canals of less capacity.

Turnouts:

All turnouts from main canals and main laterals which have a capacity of 60 second feet or over are built of concrete entirely or of vitrified salt glazed sewer pipe with a concrete head wall and wings on both intake and outlet ends. Turnouts of less capacity are constructed of timber entirely or a combination of sewer pipe with head walls and wings of timber.

Checks:

On the majority of the distributing laterals, there is a check at every turnout, except in those places where turnouts are close together. The nature of the material used for checks is governed by the capacity of the canal in the same manner as drops. There are four different designs that have proved effectual in operation: The large concrete check, the concrete low-head check, the large timber check, and the small timber sloping side check.

Timber drops:

Several designs of timber drops have been installed, but the design which has so far proven the most efficient is constructed with a water cushion and vertical curtainwall built across the top and extending down into the water cushion so as to form a well and cause the water to flow out from under the bottom of the curtainwall and raise up against the water ponded in the cushion compartment. This very materially checks the velocity and retards the tendency to cut back after leaving the apron and coming into contact with the earth section. There are about 1,000 checks, drops, division boxes and rating flumes on the project.

TOTAL ACREAGE WITHIN THE PROJECT.

Carey: 85,420.14 acres
Company Deeded: 56,811 68 acres (includes 12,552 shares of Pondera stock)
State: 7,924.00 acres
Private: 28,442.43 acres
Railroad: none
Total acreage within the boundaries of the project, 178,598.25 acres
Total acreage to be irrigated by the project 85,258 acres.

Salmon.

Total Carey acreage filed on	62,60[illegible].20 acres
Carey acreage filed on susceptible of irrigation,	45,44[illegible].21 acres
Total Company Deeded acreage sold,	39,604.00 acres
Company Deeded acreage sold susceptible of irrigation,	18,406.00 acres
Total Water Stock sold,	13,347 shares
Private lands,	13,347 shares
State lands,	no shares
Railroad lands,	no shares
Total acreage sold to date,	115,560.84 acres
Total irrigable area sold to date,	75,196.24 acres
Total Carey lands open for entry,	22,810.94 acres
Carey acreage open for entry susceptible of irrigation,	8,413.00 acres
Total Deeded acreage unsold,	5,578.59 acres
Deeded acreage unsold susceptible of irrigation,	2,475.93 acres
Total Estimated Cost of Project,	$4,350,843.57
Total Expenditures to Nov. 30, 1920:	$4,275,843.57
Price of Water rights per acre for Carey Lands:	$60
Price of Water rights per acre for Company Deeded lands:	$65
Price of Water rights per acre for lands other than above:	None
Water Rental per acre per Season on lands other than Company lands:	None

Terms of Payments on Water Contracts:

A charge of $5.00 per acre is made at the time of purchase, the balance being paid in 14 equal annual payments with interest at 6 per cent on deferred payments.

What Necessities for Drainage System Were Evident:

Wasteway from ends of canals which do not terminate in natural coulee drainage is being taken care of. Also there are about 230 acres comprising small pieces of seeped lands scattered about the project no one piece being larger than 25 acres in area and a good many of which are being farmed.

What Character of Drainage Has Been Adopted and to What Extent in Actual Construction.

About 6 miles of waste ditches have been constructed from ends of canals to coulees. No trouble is encountered after reaching the coulees. Plans have been drawn for wasteway chutes from the ends of canals which are impractical to continue to coulees on a canal gradient. These chutes will carry the water down the banks of coulees into stream beds. Test holes have been drilled with a core drill on all the important seepage areas and observations are being made of the fluctuation of the water table, the character of the water bearing strata and the velocity of the underground water. Detail topography of the surface has been taken and plotted up, the same plat showing the topography of the water table and on some tracts paper locations of tile drain systems have been made.

Amount of Water per Acre Required to be Furnished by the Carey Land Act Board:

18 inches.

Amount of Water per Acre Actually Required by the Land:

14 inches.

Method of Measuring Water to the Farm Units:

Submerged orifice.

Method of Recording Water Deliveries:

Written application for water is made by users on blanks furnished by the Company. These are left in tin boxes on user's headgates and are taken up by the Assistant Water Master or Ditch Riders and sent to the Water Master's office together with the Rider's report of delivery. The same method is pursued in shutting off water, the Rider using in addition a special report showing any interruptions or changes in flow of water from the original report. The combination of these reports dates time and amount of water used.

Amount Charged per Irrigable Acre of Maintenance as per Contract with Carey Land Act Board

$0.50

Actual Cost of Maintenance per Acre for the Year of:

1912	1913	1914	1915	1916	1917	1918	1919	1920
0.48	0.95	0.92	0.92	0.90	1.99	1.24	1.06	0.90*

*to October 1st.

SETTLEMENT DATA VALIER PROJECT.

Item	1913	1914	1915	1916	1917	1918	1919	1920
Number Farms on Project						556	683	700
Population								
Number Irrigated Farms								
Operated by Owners						337	381	380
Operated by Tenants						219	302	320
Number of Towns	4	4	4	4	4	4	4	4
Population								1656
Number of Public Schools				15	15	16	17	19
Number of Churches				7	7	8	8	8
Number of Banks				4	4	5	5	6
Total Capital Stock								
Amount of Deposits								
Number of Depositors								

CROP REPORT FOR IRRIGATED LANDS [illegible]

Year 1918.

Crops	Area acres	Unit of yield	Yields		Values		
			Total	Average pr acre	pr Unit yield	Total	pr acre
Alfalfa	3646	Ton	5260	1.5	25.00	[illegible]	[illegible]
Alfalfa seed		Bushel					
Barley	1157	do	21636	18.7	1.20	259[illegible]	[illegible]
Flax	5049	do	42972	8.5	5.20	157510	27.80
Fruits		Pound					
Garden	72	Acres			100.00	7200	100.00
Hay	4637	Ton	3928	0.85	26.20	102[illegible]	[illegible]
Oats	3593	Bushel	88236	24.6	0.90	79412	22.15
Pasture	3937	Acres			5.00	19685	5.00
Peas		Bushel					
Potatoes	121	Ton	447.7	3.7	40.00	17908	145.00
Wheat	26996	Bushel	375004	13.9	1.90	712508	[illegible]
Total cropped	49208	Total and average				1,259,719	[illegible]

Year 1919.

Crops	Area acres	Unit of yield	Yields		Values		
			Total	Average pr acre	pr Unit yield	Total	pr acre
Alfalfa	4470	Ton	6045	1.35	30.00	181350	41.50
Alfalfa seed		Bushel					
Barley	1449	do	17555	12.10	2.25	39499	27.22
Flax	4612	do	24040	5.20	5.00	120200	26.00
Fruits		Pounds					
Garden	102	Acres				12425	122.00
Hay	4665	Ton	2228	0.50	26.50	59015	13.25
Oats	4079	Bushel	65779	16.10	1.00	65779	16.12
Pasture	3785	Acres			5.00	18925	5.00
Rye	257	Bushel	591	2.30	2.25	1330	5.17
Potatoes	154	Ton	357	2.40	100.00	35700	240.00
Wheat	32128	Bushel	306016	9.50	2.75	841544	26.19
Total cropped	55701	Total and average				1394910	25.04

TETON PROJECT.

This project situated in Pondera County lies between the Valier Carey Project and the U.S.R.S. Sun River Project. The soil and climatic conditions are very similar to these projects practically assuring its ultimate success upon completion.

The project comprises an area of 34,206.60 acres of which 17,725.13 acres have been approved by the Department of the Interior and 16,441.47 acres of the segregation are still pending.

The Company contracting with the State for the reclamation of these lands have expended a considerable sum in the construction of various structures which have been built in a very substantial manner.

The statement of the Company up to October 31, 1920, is as follows:

ITEMIZED DESCRIPTIVE STATEMENT BY THE COMPANY.

Name of Project: Teton Project.

Name of Company: Teton Co-operative Reservoir Company.

Post Office Address: Helena, Montana.

LOCATION.

Counties: Pondera and Teton Counties.

Townships 26 to 27 N., Rgs. 2 E to 3 W. Montana Meridian.

Railroads: Great Northern.

Railroad Stations: Brady, Montana.

Population of Towns: Brady, 200.

AGRICULTURAL AND CLIMATIC CONDITIONS.

Average elevation of irrigable area 3500 feet above sea level.

Topography: Gently rolling land, sloping northeasterly about 25 feet per mile

Rainfall on irrigable area for 7 years, average 15.9 inches; for 1919, 9.63 inches, for 1920, 12.30 inches up to October 1, 1920.

Range of temperature on irrigable area: -35° to 95° F.

Length of irrigating season April 15 to Sept 15; 150 days.

Character of soil of irrigable area: Sandy loam.

Principal products of project: Surrounding lands produce all small grains, potatoes, alfalfa and live stock.

Principal markets: Great Falls, Spokane, Twin Cities.

DESCRIPTION OF WATER SUPPLY.

Streams from which water supply is obtained: Teton River, Muddy Creek and Blackleaf Creek.

Whether natural flow, stored water or both: Both.

RESERVOIRS

1. Bynum Reservoir area [illegible] acres, capacity 80,[illegible] acre feet.

2. Kropp Reservoir area 800 acres, capacity [illegible] acre feet.

CANALS LEADING FROM STREAMS TO LAND OR RESERVOIR.

Intake Canal 4½ miles long, capacity 500 second feet.

Length of main canals from reservoir completed: None.

Length of main canals from reservoir to be built: 28 miles.

Length of main laterals completed: None.

Length of main laterals to be built: Not determined.

Difficulty of construction: Canals built thru earth with occasional spots of gravel and hard pan.

GENERAL DESCRIPTION AND LENGTH OF [illegible].

One canal [illegible] inches in diameter. The concrete [illegible] inches internal diameter, [illegible] feet long. [illegible] drops [illegible] with total fall of [illegible].

Total acreage within the boundaries of the project: [illegible] acres, all of which is Carey Land.

Total acreage to be actually irrigated by the project: First unit, 15,[illegible] acres; Second unit, 13,700.25 acres.

Sales:

None.

Total estimated cost of the project: $950,000.00

Total expenditures up to June 30, 1920: $410,000.00

Price of water rights per acre for Carey lands: Not determined.

Terms of payments on water contracts: Not determined.

What necessities for a drainage system have arisen? None.

Amount of water per acre required to be furnished by the Carey Land Act Board: 1½ acre feet per acre.

Amount of water per acre actually required by the land: Estimated to be 1½ acre feet per acre.

Method of measuring water to the farm units: Not determined.

Method of recording of water deliveries to farm units: Not determined.

Amount charged per irrigable acre for maintenance as per contract with the Carey Board: Not settled.

SETTLEMENT DATA.

Actual delivery of water to the Carey lands has not yet commenced. The concrete diversion dam and gates in the Teton River have been completed; the intake canal from the Teton River diversion dam to the Bynum Reservoir is delivering water but is not yet completed to its full capacity. The Bynum Reservoir is completed to an elevation of 4165 feet above sea level, elevation of 4170 feet above sea level being the ultimate height of the completed structure. The reservoir is now delivering water to the full capacity of canals for the irrigation of several thousand acres of land near Brady, under the Brady Irrigation Company's canal, the latter Company having stock in the Teton Co-operative Reservoir Company.

FLATWILLOW PROJECT.

This project lies southeast of Lewistown in Eastern Fergus County and comprises 7,768.80 acres of Carey Act lands segregated to the State for the purpose of reclamation by the Federal Government in Montana Segregation List No. 21.

The Company contracting with the State for the reclamation of these lands has been seriously handicapped in financing the work on account of the Great War and the present money stringency.

They have added to their list of stockholders, several substantial men during the past two years. During the past year construction was resumed on the pricipal distributing canal from Stations 256 to 193, a distance of 6250 feet. Approximately 13,500 cubic yards of material were moved at a cost of $5,500. Plans are being formulated for the resumption of construction on a larger scale during the coming year.

The project was inspected by the United States Reclamation Service during the year of 1919. Mr. R. H. Fifield then Manager of the Huntley Project wrote a report after making a comprehensive examination.

The conclusions reached in this report were to the effect that the project is thoroughly practical presenting very few engineering difficulties, has a very high average quality of soil and the advantages of natural drainage. In other words the project can be economically constructed and is particularly meritorius.

The statement of the Company up to November 30, 1920, is as follows:

ITEMIZED DESCRIPTIVE STATEMENT OF THE COMPANY.

Name of the Project: Flatwillow Project.

Name of Company: Fergus County Land & Irrigation Company.

Post Office Address: Lewistown and Winnett, Montana.

LOCATION.

County: Fergus County.

Townships 12 to 13 North, Rgs. 26 to 27 E. Montana Meridian.

Railroads: Chicago, Milwaukee & St. Paul, Great Northern.

Railroad station: Winnett.

Population of town: Winnett, 1,000.

AGRICULTURAL AND CLIMATIC CONDITIONS.

Average elevation of irrigable area 3,000 feet above sea level.

Topography: Mostly bench lands, small area of broken land and approximately one-third bottom lands.

Rainfall on irrigable area for 10 years, average 14 inches; for 1919, 9.73 inches; for 1920, 10.63 inches up to October 1, 1920.

Range of Temperature on irrigable area: -45° to 105° F.

Length of irrigating season May 1 to Sept 15, 138 days.

Character of soil of irrigable area: Clay loam generally with stiff clay interspersed with broken lime rock.

Principal products of project: Small grains, corn, alfalfa.

Principal markets: Winnett, Grass Range, Lewistown, Twin Cities.

DESCRIPTION OF WATER SUPPLY.

Stream from which water supply is obtained: Flatwillow Creek.

Whether natural flow, stored water or both: Both

Water otherwise appropriated on stream: 1416 miner's inches below point of diversion.

NUMBER OF RESERVOIRS.

1. Flatwillow Reservoir, area 475 acres, capacity 19,500 acre feet.
2. May be constructed, area 550 acres, capacity 5,000 acre feet.

CANALS LEADING FROM STREAMS TO LAND OR RESERVOIRS.

Supply Canal, 1.25 miles long, capacity 450 second feet.

No. 1 Canal, 14 miles long, capacity 240 second feet.

No. 2 Canal, 12 miles long, capacity 300 second feet.

Length of Main Canals from Reservoir Completed: 3 miles.

Length of Main Canals from Reservoir to be Built: [illegible] miles.

Length of Main Laterals completed: None.

Length of Main Laterals to be Built: Not determined.

Length of Distributing Laterals completed: None.

Length of Distributing Laterals to be Built: Not determined.

Total Length of Canals & Laterals Completed: [illegible] miles.

Total Length of Canals & Laterals to be Built: about [illegible] miles.

GENERAL DESCRIPTION AND NUMBER OF STRUCTURES

Dam:

At an elevation of 80 feet above the creek bed the crest line is 1100 feet long. The two abutments consist of large bodies of sandstone outcrop. Bed rock is visible in the dry creek bottom and is close to the surface along the profile of the structure. Earth fill dam containing about 500,000 cubic yards of material of which approximately one third is in place. Upstream side to be riprapped with rock.

Spillway:

To be built of concrete and placed entirely away from the dam over a low saddle.

Outlet:

The outlet is a rock tunnel arranged to pass to the [illegible] and not thru the dam.

Diversion Dam:

The diversion dam is to be built in [illegible] Creek, of re-inforced concrete and earth.

ENGINEERING DIFFICULTIES.

Practically none.

Total acreage within the boundaries of the project: About 19,000 acres.

Carey: 7,735 acres

Company Deeded: none.

Private 11,000 acres

State: none

Railroad: none

Total acreage to be actually irrigated by the project: 15,000 acres.

Sales.

Total Carey acreage filed on: none

Total Company deeded acreage sold: none

Total water stock sold: 1,750 shares

Private lands 1,750 shares

State lands: none

Railroad lands: none

Total estimated cost of the project: $500,000.00

Total expenditures to December 31, 1924. $ 11,925.00

Price of water rights per acre for Carey lands: $50.

Price of water rights per acre for lands other than above: $50.

What necessities for a drainage system are evident: none.

Amount of water per acre required to be furnished by the Carey Board: 1½ acre feet per acre.

Amount of water per acre actually required by the land: 1½ acre feet per acre.

Method of measuring water to the consumer: Not determined.

Method of recording of water deliveries: Not determined.

Amount charged per irrigable acre for maintenance under contract with Carey Land Act Board: Not provided.

LITTLE MISSOURI PROJECT.

This project embracing a total segregation of 20,607.9 acres lying in the Valley of the Little Missouri River is situated in Carter County in the southeastern corner of the State.

The Company contracting with the State for the reclamation of the lands under this project have been unable to proceed with construction during the past two years owing to the stringent condition of the money market.

They believe that as soon as the situation improves, they will be able to interest parties with sufficient financial backing for the completion of the work.

The statement of the Company up to October 31, 1920, is as follows:

ITEMIZED DESCRIPTIVE STATEMENT BY THE COMPANY.

Name of Project: Little Missouri Project.

Name of Company: Little Missouri Land & Irrigation Company.

Post Office Address: 520 Daly Bank Building, Butte, Montana.

LOCATION:

County: Carter County.

Townships 5 to 9 S., Rgs. 60 to 62 E. Montana Meridian.

Railroads: None.

Railroad Stations: None.

Population of Towns: Capitol, 50.

AGRICULTURAL AND CLIMATIC CONDITIONS.

Average elevation of irrigable area 3000 feet above sea level.

Topography: Uniformly level and unbroken sloping gently toward the river making arrangements for drainage unnecessary.

Rainfall on irrigable area for 16 years, average 14.26 inches; for 1919, 6.50 inches; for 1920, 11.37 inches up to October 1, 1920.

Range of temperature on irrigable area, -25° to 100° F

Length of irrigating season May 1 to Sept 15; 138 days.

Character of soil of irrigable area: Sandy clay loam.

Principal products of project: All grains, hay, live stock.

Principal markets: Belle Fourche, S. Dakota.

DESCRIPTION OF WATER SUPPLY.

Stream or streams from which water supply is obtained: Little Missouri River and Cottonwood Creek.

Whether natural flow, stored water or both: Both.

RESERVOIRS.

1. Cottonwood Creek, area 1500 acres, capacity 20,000 acre feet.

CANALS LEADING FROM STREAMS TO LAND OR RESERVOIRS.

Intake Canal, 5½ miles long, capacity 500 second feet.

Main Distributing Canal, 25 miles long, capacity 500 second feet.

Length of main canal from reservoir completed: 10 miles.

Length of main canals from reservoir to be built: 15 miles.

Length of main laterals completed: None.

Length of main laterals to be built: No data.

Total length of canals and laterals completed: 10 miles.

Total length of canals and laterals to be built: No data.

Character of construction: Earth.

ENGINEERING DIFFICULTIES.

None.

Total acreage within the boundaries of the project: 26 000 acres

Carey:	20,607 acres
State.	1,280 acres
Private:	4 200 acres.

Total acreage to be actually irrigated by the project. 20,000 acres.

Sales:

None.

Total Carey Act lands open for entry: 20,607 acres.

Total estimated cost of the project: $250,000.00

Total expenditures to October 1920: $ 32,000.00

Price of water rights per acre for Carey lands: $40

Price of water rights per acre for Company lands: $40

Terms of payments on water contracts: $5.00 cash per irrigable acre is made at the time of purchase and the balance in ten equal annual installments with 6 per cent interest on deferred payments.

What necessities for drainage have arisen? There will be no provisions necessary for drainage due to the slope to the river.

Amount of water per acre required to be furnished by the Carey Board: 1½ acre feet per acre

Amount of water per acre actually required by the land? Not determined.

Method of measuring water to the farm units: Not determined.

Method of recording water deliveries to the farm units: Not determined

Amount charged per irrigable acre for maintenance as per contract with Carey Board: 50 cents per acre.

Actual cost of maintenance per acre; Not determined

SUMMARY OF THE PROJECTS.

Billings Project,	approved	list	No 1	10,472.88	acres
Big Timber Project,	"	"	No 2	7,829.84	"
Big Timber Project,	"	"	No 3	400.00	"
Billings Project,	"	"	No 7	2,750.66	"
Valier Project,	"	"	No 8	60,301.41	"
Big Timber Project,	"	"	No 9	1,360.00	"
Teton Project,	"	"	No 10-A	17,725.13	"
Teton Project,	pending	"	No 10-B	16,441.47	"
Big Timber Project,	approved	"	No 11	1,709.32	"
Valier Project,	"	"	No 12	3,596.58	"
Valier Project,	"	"	No 14	21,522.15	"
Flatwillow Project,	"	"	No 21	7,768.80	"
Little Missouri Project,	"	"	No 22	20,607.98	"
	Total,			172,486.22	"

APPROVED CAREY LAND SALES.

Billings Project,	12,264.62	acres.
Big Timber Project,	6,174.94	"
Valier Project.	62,817.38	"
Total	81,256.94	"

UNITED STATES PATENTS TO THE STATE.

Billings Project,	13,223.54	acres.
Big Timber Project	8,229.84	"
Valier Project.	34,708.92	"
Total,	56,162.30	"

PATENTS ISSUED TO SETTLERS.

Billings Project,	9,876.39	acres
Big Timber Project.	3,619.32	"
Valier Project.	31,781.07	"
Total,	45,276.78	"

STATEMENT OF INCOME FOR YEARS 1919-1920.

Land Sales,	$12,386.46
Filing Fees.	87.00
Final Proof	146.00
Patents,	369.00
Miscellaneous.	123.00
Unfinished Business,	1.00
Total,	$13,112.46